with the rest of the body stiffened and suspended in mid-air, testified to violent and prolonged resistance. Some ants again had the body arched up, as if to avoid contact with the stem, and the legs only were fatally caught.

As is well known, the glutinous or sticky tracts lie around the stem directly beneath the nodes, and are about half an inch or more in depth. These glutinous zones are absent from the nodes, which are lower down on the stalk. But a darkening of the colour, just similar to what one sees below the sticky nodes, suggests the probability of these non-sticky nodes having been sticky at some former time.

I can find no reference in the ordinary books to the fact that ants visit, and die upon, this plant. In Smith's "English Botany," 1800, however, occurs the following remarkable account of *Lychnis viscaria*:—"Stem straight, about a foot high, simple, angular, leafy, dark brown, and clammy under each joint, by which insects are plentifully caught, as in several other plants of the pink or campion tribe, for what purpose no one has yet ascertained; probably their decaying bodies form an air which is salutary to vegetable life." As I do not quite understand the author's meaning in the latter part of his remarks I naturally forbear criticising the statement, and mention it here merely to show the opinion of a botanist on the subject eighty-one years ago.

On each flowering stem there are from two to four sticky nodes. I found that the majority of the deaths had occurred in the first zone of stickiness; fewer in the second, and still fewer at the higher nodes. Those ants therefore which gained the summit of their ambition would be pre-eminently strong and lusty, for to have arrived at the top of the plant among the flowers, they must have waded through morasses, each of which was sufficient to cause the death of many of their comrades. I found very few ants at the summit of the flowering stalks, and those that I did find there alive showed, from their want of vigour and restlessness, that they had been severely tried by the ordeals through which they had passed. The plant was growing in very rocky soil, each specimen quite isolated from any surrounding vegetation; so that I am satisfied that no ants, on the plants I examined, could have gained the summits by adventitious aids.

Time and the want of proper apparatus prevented my making some experiments I wished to have tried, and as I do not know when again I shall be able to pursue this most interesting investigation, your kind insertion of this may perhaps induce some of your readers to pursue the subject further. These are amongst the questions which have occurred to me:—(1) Is there any attraction in the glutinous secretion, or does the attraction lie in the flowers? I saw no ant-hills or nests anywhere in the neighbourhood of the flowers, and my impression at the time was that the ants had come a long distance. I scrutinisingly examined the ground, and, to my astonishment, found that almost the only ants on the spot were upon the plants. (2) How is it, if these sticky zones are simply to prevent ants and other small walking animals from getting to the flowers, that they do not occur at the lower part of the stem as well as higher up? (3) What injury, if any, do ants cause to this plant? (4) Is it likely that the plant derives direct benefit from the deaths that take place upon it? Is there, in short, any digestive action in the glutinous secretion, and any absorptive power in those portions of the stem where it is found?

I brought home some specimens showing the dead bodies of ants stuck to the flower stalks, and these were exhibited at the last meeting of the Linnean Society. I shall be happy to show them to any who are interested in the subject. J. HARRIS STONE

11, Sheffield Gardens, Kensington, December 2

Solar, Gas-Flame, and Electric-Light Spectra

IN answer to Mr. J. Hopkins Walters' inquiry contained in NATURE, vol. xxv. p. 103, the spectroscope declares that all these three spectra have for their base a continuous strip or band of light; in the case of gas-flame (the bright part) crossed by the sodium lines only; in that of the sun by the well-known Frauenhofer dark lines; and of the electric (arc) light by the bright lines of carbon. The illuminating power of each of these sources of light is thus shown to be due to the incandescence of their several solid and gaseous constituents, concerning which a volume might be written. The relative effect of the sun's bright golden glare, the gas-flame's duller yellow tint, and the electric-light's moon-like whiteness, on the optic nerve; have not, as far as I am aware, been yet made the subject of special research. Popular opinion assigns injurious results to the whiter light. Mr. Walters will find in "Photographed Spectra," on Pl. xv., Fig. 4, and the extra plate, the solar spectrum, and on Pl. v., Figs. 3 and 4, the spectrum of the electric arc between carbon points specially prepared to insure purity. In Dr. Marshall Watt's "Index of Spectra" the spectrum of the blue base of candle-flame is represented by the graphical diagram and description, Carbon I. The illuminating portion of a gas-flame presents in the spectroscope the appearance of a dull sun spectrum without the dark lines. J. RAND CAPRON

Guildown, December 3

Tele-dynamics and the Accumulation of Energy—their Application to the Channel Tunnel

A REMARKABLE opportunity is now presented to electrical and mechanical engineers of applying to eminent practical service the recent discoveries and advances made in relation to the accumulation and transmission of energy in the form of electricity. I allude to the construction and working of the Channel Tunnel Railway. Of course the direct application of steam-power to the work of boring is out of the question. The power employed in boring Mont Cenis and St. Gothard was transmitted by compressed air through metal tubes, but this is a very costly, wasteful, and in some respects inconvenient process; and this cost and waste increases in a very high ratio to the distance of transmission. Since those works were executed an immense advance has been made in the practice of transmitting energy by electric current, and particularly in storing that energy; and I predict that if the tunnel is ever completed (which I do not doubt) it will be by means of electrical agency. An eminent civil engineer, who had invented a boring-machine which he considered of great promise for that work, told me more than a year ago that Dr. Siemens assured him that he would undertake to transmit 50 per cent. of the initial power by electric current half way through the tunnel; and by this time he would most probably give a much larger percentage. An eminent French authority promises from sixteen to twenty horse-power by a single current over a distance of from ten to fifty kilometres. If these statements are founded on fact your readers will at once realise the applicability and potency of the agent. Then there must of necessity be an immense quantity of material to be carried to and fro. The electrical railways of Berlin, Brussels, and Paris have left no question open as to the easiest and most economical means of propelling the trollies; and by using several conductors as many trolly trains in succession could be run as there would be conductors. It would be premature to discuss now the subject of working this railway, but it is certain that electricity will be the agent, and there is very little doubt that the twenty miles of level tunnel way will be worked by energy generated and stored by the train itself in its descent from the land level to the tunnel level. An examination of this question in detail would be incompatible with your space and purpose. I will simply say that a train of 100 tons descending a gradient of 1 in 100 for five miles would start with a potential force of nearly 60,000,000 foot pounds, a very small portion of which would be expended in useful work. Let the surplus of this be applied not to destroying the rails by brakes and conversion into useless heat, but by revolving generators and storing the product to be used in again turning the generators (now motors) for propelling the train. I do not say that the train could be lifted up the five miles at the other end by this stored energy: the engineers may be intrusted with that duty. E. WALKER

Tottenham

JOHNSTON LAVIS.—Your paper wants beginning and title. Please send.

DANTE AND THE SOUTHERN CROSS.—A correspondent inquires where Dante could have learned about the Southern Cross, to which there is evident allusion in the first canto of the "Purgatorio."

JAMAICA

OF all the West Indian Colonies appertaining to the British Crown, that of the Island of Jamaica can claim to be the largest in area, the most numerous in population, and the wealthiest in revenue. Within half a

century of being the oldest of the English possessions in the new world—Barbadoes was settled in 1605 ; Jamaica was capitulated in 1655—it has, though with many vicissitudes, been the most successful, and it has always shown strong signs of a healthy life, in that it has recovered promptly and well from its periods of misfortune. The extreme length of this fertile island is about 144 miles, while its greatest width is 49, and its least width 21 miles. Its surface is extremely mountainous, attaining a maximum in the Blue Mountain Peak of some 7360 feet. Of its superficial area of 4139 square miles only about 646 are flat, consisting of marl, alluvium, and swamps. It possesses numerous rivers and springs, and a fertile soil. Its total of population in 1861 was 441,264; in 1871, 506,154.

A Handbook to Jamaica, compiled from official and other records, has lately been published at the Government printing establishment at Kingston. It has been most judiciously edited by two members of the Jamaica Civil Service, and forms a volume of 450 pages, which deserves to be known to all interested in our colonies. Passing over the first two parts of the volume, which contain matter of chiefly local interest, the third part contains a chronological history of the island, with an account of its various parishes, its mountain ranges, lakes, and rivers, and an excellent sketch of its mineral resources, from which it would appear that the natural resources of the island have not as yet been satisfactorily explored. The fourth part is devoted to the consideration of the meteorology and climate, and of the birds, fishes, and insects of the isle.

Mr. Maxwell Hall is to be congratulated, that, after some opposition and under great difficulties, he has succeeded in some measure in establishing a system of daily weather reports, which are sent daily to the local press for publication. As the result of the reduction of a series of observations on the rainfall in different stations, and extending over periods of from five to fifteen years, Mr. Hall has been able to make out a certain systematic distribution of the rainfall over the island. It would thus appear that, while the May and October rains are everywhere strongly marked, the northern part of the island has winter rains in November, December, and January, the southern part has summer rains in August and September; and it would appear from the tables given that each part is further divided by the amount of the rainfall. Thus the north-eastern has the greatest rainfall; the west central comes next; the northern division third, and the southern has the least annual rainfall. Some such distribution, Mr. Hall thinks, was also existing at the time Sir Hans Sloane wrote his "Natural History of Jamaica" (about 200 years ago), and although he sees in the records of Sloane a change in the rainfall, yet he believes this to be not a constant change, such as might indicate a continually diminishing rainfall, but a variable change, probably systematic and periodic. On the question of the influence of forests on the rainfall, he decides that woods and forests are chiefly beneficial in reducing the range of temperature, and in maintaining the moisture of the ground, thereby preserving a constant supply of water for the springs and rivers. It may be noted that the central and uncultivated parts of Jamaica are still densely wooded, thereby aiding the constant river supply. Jamaica has two rainy and two dry seasons. The rainy seasons are in May and in October, lasting about two months, the intervening periods being dry. The climate may generally be described as a sedative one.

The Catalogue of the Birds of Jamaica is compiled by the well-known ornithologists Alfred and Edward Newton, the latter Colonial Secretary. Forty-three birds are enumerated as presumably peculiar to the island, that is to say, not known to have been found elsewhere. The list of the fishes is large. The river chub (*Labrax mucronatus*) is described as a "surpassingly delicious fish." Though fish abound in the seas, and each district has a sea-frontage, yet the yearly importation of cured "fish stuffs" of different kinds amounts in value to 200,000*l.* a year. To help and remedy this state of things the Jamaica Institute has offered a series of prizes for preserved fish.

The fifth and sixth parts treat of the economic botany of the island. The Government Surveyor, in reporting on the timber supply, estimates that there are at present about 800,000 acres of timber-producing forest in the island; that out of this there might be cut each year—without permanent injury—400 feet to the acre, say 320,000,000 as an annual supply; of this large amount only some 3,500,000 a year are actually cut for building purposes. About 166,000*l.* worth of fine timber was exported in 1880, but a large quantity of lumber and shingles is imported. This state of things Mr. Harrison accounts for by the difficulty of getting the timber out of the mountain fastnesses where it grows. He does not seem to agree with Mr. Hall on the subject of the change in the rainfall, for he declares that he has ascertained beyond doubt that forests exercise a great influence on it, that where the forests have been destroyed the rainfall has diminished, and he alludes to springs becoming dried up, and rivers that have ceased to flow. A very interesting list of some fifty of the woods of Jamaica, their qualities and the uses they are generally put to, is appended to this report. The island would appear to be a paradise for the fern collector, over 450 species being enumerated. Within a radius of five miles, taking Morce's Gap as a centre, over 200 species are to be found. The orchids are not so numerous, only 135 being named.

Of the main crops of the island, sugar still heads the list, the value of that exported in 1880 being 768,792*l.* The value of the coffee raised in the island in the same year is calculated at 381,595*l.* The coffee of the Blue Mountains is celebrated for its superiority, but a good marketable article is grown throughout the island. In a most valuable report by Mr. Morris, the present Director of Public Gardens strongly urges the propagation of the Liberian coffee, which was introduced in 1874. From the fact that this coffee will grow on the plains, where the preliminary expenses in the acquisition and clearing of land are lower than on the hills, where labour, too, is cheaper and more abundant, and where the difficulties and expenses of labour would be avoided, Liberian coffee possesses advantages not only over the Arabian coffee, but over almost any cultivation requiring the same capital and attention. Among the minor crops, that of the fruit crop is steadily and remarkably increasing in value, from 10,000*l.* in 1834 to 51,000*l.* in 1880. Jamaica tobacco is finding its way into the market. In the German markets —considered the most important for leaf-tobacco—Jamaica tobacco is well thought of, and in price ranks next to Havanna leaf, and since 1879 the consumption of Jamaica cigars in England has spread in an extensive manner. The cocoanut export, from a value of 3,357*l.* in 1870, has risen to 20,525*l.* in 1880. Ginger, pimento, and cacao are all successfully grown. The introduction of cinchona cultivation into Jamaica through a liberal supply of seeds sent in 1861 by Sir W. J. Hooker, promises to be a great success. For the year 1879-80 the quantity of bark shipped was 27,399 lbs., which realised the net sum of 5146*l.* From an elaborate report by Mr. Morris we take the following:—The plantations are estimated to cover nearly 400 acres; owing, however, to the practice of wide planting, the actual area occupied by regularly-planted trees is probably only a half of this. The advantages of close planting are undoubted. The climate of Jamaica would seem to be peculiarly well adapted for the successful cultivation of one or other of the various species of cinchona, at all elevations, from about 2500 feet to the Blue Mountain Peak itself. Thus *Cinchona succirubra* flourishes in the parish of Manchester at an elevation of

2700 feet, with a rainfall of about 120 inches and a mean annual temperature of 70° Fahr. This is perhaps the lowest elevation for the more valuable cinchonas at the Government plantations; the same species flourishes at 5000 feet, with an annual rainfall of 136 inches and a mean annual temperature of 60° F. The trees at this elevation do not seed freely, and it may be taken as the highest at which it would be advisable to cultivate the red bark in Jamaica. The range of cultivation for the valuable crown bark (*Cinchona officinalis*) is between 4500 and 6300 feet of elevation. It may here be convenient to refer to the department—that of Public Gardens and Plantations—which was newly organised in 1879. This department has under its control the Botanic Gardens at Castleton and Bath, the Park at Kingston, the Cocoanut Plantation at Kingston Harbour, and the Hope and Cinchona Plantation. The staff is directed by Mr. Daniel Morris, M.A., who had been assistant at the Ceylon Botanic Gardens. To an island dependent as Jamaica is for its prosperity on the produce of its soil, the importance of such a department is undoubted, and we trust that the new director will receive all due encouragement in developing the botanical treasures of the place.

The concluding parts of this most interesting handbook are devoted to the political constitution and parochial boards of the island; to the details of the various departments and colleges; to the statistics of population, crime, &c.; to the laws of quarantine, &c.; together forming a most useful volume of reference. There seems little doubt that if the capabilities of Jamaica were better known, it would attract the attention of settlers. There are surely as great attractions in bark or coffee-growing as in wool-growing, and Jamaica is nearer to us than the Australian colonies, and, with due precautions, as healthy a climate to live in.

OUR WINTER REFUGES—THE SOUTH OF ENGLAND[1]

II.

AS regards temperature and rainfall the South of England, from Dover to Portland, presents a unique and well-marked winter climate, quite distinct from that of any other tract of the British Islands. The tract in question embraces the comparatively narrow belt, varying in width from two to ten miles, stretching between these two places and backed on the north by the sheltering range of the South Downs.

The rainfall in the east of England, from the Humber to Ramsgate, varies in the average annual amounts from 22 to 25½ inches; but on reaching Dover it rapidly rises to 30 inches, and from this point westward to Portland the rainfall varies only from 28 to 30 inches, the amounts differing within these narrow limits according to the flatness or boldness of the coast, and the character of the country in the immediate neighbourhood. To the west of Portland, along the coast, the rainfall rises considerably, and after passing Prawle Point, more rapidly to 44 inches at Penzance. Further, on striking inland from the coast towards and up the slopes of the Downs, the annual amounts increase to about 34 or 36 inches, on the high grounds separating the valley of the Thames from the lands sloping south to the channel; and from this ridge northwards it gradually falls to about 25 inches round London. Thus the Downs, as regards the rainfall and the winds, have important bearings on the meteorology of the south of England.

Equally decided are the temperature characteristics which mark off, climatically, these districts of England from each other. We may accept January as fairly representing the temperature peculiarities of the winter months. In this month the mean temperature of the whole of the eastern slope of Great Britain, from Wick to Dover, varies only from about 37°·5 to 38°·5, the temperature of the coasts being a little higher than that of the interior. But on arriving at Dover we encounter a January mean temperature of 40°·0, and from this point westward there is a steady increase, first slow as far as Worthing, where the mean is 40°·4, and then more rapid to Bournemouth, where the mean is 41°·2. On advancing inland upon the Downs, temperature falls much more rapidly than what is due to mere height, and this fall is continued in proceeding northwards towards London, the mean of which is 2°·5 and 1°·5 lower than that of Bournemouth and Brighton respectively. West of Portland the increase of temperature is still more rapid, the mean being 42°·9 at Torquay, 44°·6 at Falmouth, and 46°·2 in the Scilly Isles, the last temperature being the mean of London in the beginning of April.

Hence if the invalid requires a winter climate characterised by the combined qualities of mildness and dryness, such a climate must be sought for on the shores of the Channel from Dover to Portland. In the south-west a much higher temperature may be had, but the climate is there damper, and raw weather is of much more frequent occurrence; and in the eastern counties the climate is as dry, or rather drier, but the temperature of the air is from 2°·0 to 3°·0 colder.

The south coast possesses another climatic advantage of no small importance. The prevailing winds in the south during the winter months are west-south-westerly, and thus the winds which blow over the Isle of Wight pass on in the direction of London. Now we have seen that in passing from the Isle of Wight to London the mean temperature gradually falls 3°·0—the depression being due to the more rapid rate at which the land, as compared with the sea, is cooled down by terrestrial radiation. From this steady and continued lowering of the temperature of the south-westerly winds as they advance inland from the coast, it follows that haze and cloud are formed with greater frequency and of greater denseness as the winds successively advance into the colder districts. Hence the skies of the south coast are clearer and brighter than in the valley of the Thames—a consideration of the highest climatic significance in the cure of many diseases.

The generally light and porous character of the soil and subsoil along the south coast is a strong recommendation in favour of the sanataria of that region; because, as it affords a ready escape for the rain, the roads are quickly dry, and out-door exercise may be safely indulged in shortly after the rain has ceased. The generally bold character of the coast and sloping character of the surface is also advantageous as offering facilities for carrying out an effective system of drainage.

We have referred to the Downs as affording more or less shelter to the south coast from northerly winds, and to the Undercliff as a protection to Ventnor from north-east, north, north-west, and west winds (NATURE, vol. xxv. p. 33). Indeed the chief source of the advantages possessed by one of these watering-places of the south over another is the degree of protection it holds out from the deleterious effects of the easterly and north-easterly winds, and in some degree also to its distance from those parts of the Continent from which the east wind blows. Of the strictly local peculiarities which give one place a decided preference over another is the extent to which the district is planted with well-grown trees, by which the force of the winds, particularly east winds, is broken up and dissipated. In this respect the firs which have been planted in and around Bournemouth strongly recommend this sanatarium to the invalid, since, if fair overhead, he can almost always take outdoor exercise along the walks and promenades which are so completely sheltered by these evergreens. Bournemouth has the additional advantage of being to some extent protected from the full violence

[1] Continued from p. 34.